CLAIMS

1. A varactor shunt switch comprising:
a substrate;
a metal electrode deposited on said substrate;
a ferroelectric thin-film deposited on said metal electrode; and
a coplanar waveguide transmission line on top of said ferroelectric thin-film.

2. The varactor shunt switch of claim 1, wherein said substrate is a single layer low loss microwave substrate.

3. The varactor shunt switch of claim 1, wherein said substrate is multilayered.

4. The varactor shunt switch of claim 3, wherein said multilayer substrate comprises:
a high resistivity silicon layer;
a silicon oxide layer on top of high resistivity silicon layer;
an adhesion layer deposited on said silicon oxide layer;
a metallic layer deposited on top of said silicon oxide layer; and
a tunable ferroelectric thin-film dielectric layer coated on top of said metallic layer; and
a top metal electrode defining a coplanar waveguide transmission line.

5. The varactor shunt switch of claim 4, wherein said high resistivity silicon layer has a thickness of about 20 mils.

6. The varactor shunt switch of claim 4, wherein said high resistivity silicon layer has a resistivity of > 1 kΩ-cm.

7. The varactor shunt switch of claim 4, wherein said silicon oxide layer has a thickness of about 200 nm.

8. The varactor shunt switch of claim 4, wherein said adhesion layer comprises of titanium.

9. The varactor shunt switch of claim 4, wherein said adhesion layer has a thickness of about 20 nm.

10. The varactor shunt switch of claim 4, wherein said metallic layer further comprises:

a gold layer deposited on said adhesion layer; and

a platinum layer deposited on said gold layer.

11. The varactor shunt switch of claim 10, wherein said gold layer has a thickness of about 400 nm

12. The varactor shunt switch of claim 10, wherein said platinum layer has a thickness of about 100 nm

13. The varactor shunt switch of claim 4, wherein said metallic layer has a thickness of about 500 nm.

14. The varactor shunt switch of claim 4, wherein said metallic layer is deposited and lifted off by electron beam deposition and standard lift-off photolithography.

15. The varactor shunt switch of claim 4, wherein said metallic layer is deposited and lifted-off by sputtering and standard lift-off photolithography.

16. The varactor shunt switch of claim 4, wherein said metallic layer comprises of at least two ground conductors and a shunt conductor.

17. The varactor shunt switch of claim 2, wherein said tunable ferroelectric thin-film dielectric layer has a high dielectric constant.

18. The varactor shunt switch of claim 17, wherein said high dielectric constant of said tunable ferroelectric thin-film dielectric layer is greater or equal to about 200 at zero bias.

19. The varactor shunt switch of claim 4, wherein said tunable ferroelectric thin-film dielectric layer has a thickness of about 400 nm.

20. The varactor shunt switch of claim 4, wherein said tunable ferroelectric thin-film dielectric layer is comprised from one of barium strontium titanium oxide, strontium titanate, or combinations of any other nonlinear electric field tunable dielectric thereof.

21. The varactor shunt switch of claim 4, wherein said tunable ferroelectric thin-film dielectric layer is comprised of barium strontium titanium oxide.

22. The varactor shunt switch of claim 4, wherein said tunable ferroelectric thin-film dielectric layer is deposited using pulsed layer deposition.

23. The varactor shunt switch of claim 4, wherein said tunable ferroelectric thin-film dielectric layer is deposited using RF sputtering.

24. The varactor shunt switch of claim 4, wherein a varactor area of said varactor shunt switch is defined by the overlap of said top metal electrode and said patterned bottom metallic layer.

25. The varactor shunt switch of claim 24, wherein said varactor area is between about 1 μm^2 to about 500 μm^2.

26. The varactor shunt switch of claim 1, wherein said metal electrode comprises:

a central signal strip; and

at least two ground conductors.

27. The varactor shunt switch of claim 26, wherein said central signal strip has a width of about 50 μm.

28. The varactor shunt switch of claim 26, wherein said at least two ground conductors have a width of about 150 μm.

29. The varactor shunt switch of claim 26, wherein said metal electrode has a spacing between said central signal strip and said at least two ground conductors of about 50 μm.

30. The varactor shunt switch of claim 26, wherein said metal electrode has a spacing that has a geometric ratio equal to about 0.333 of said coplanar waveguide transmission line.

31. The varactor shunt switch of claim 1, wherein said varactor shunt switch is normally in an "OFF" state.

32. The varactor shunt switch of claim 1, wherein said coplanar waveguide transmission line has about 40 to about 50 Ω characteristic impedance.

33. The varactor shunt switch of claim 1, wherein said metal electrode is comprised of gold.

34. The varactor shunt switch of claim 1, wherein said metal electrode is deposited and lifted-off using electron-beam deposition and standard lift-off photolithography.

35. The varactor shunt switch of claim 1, wherein said metal electrode is deposited and lifted-off using sputtering and standard lift-off photolithography.

36. The varactor shunt switch of claim 1 has an area of approximately 450 μm by approximately 500 μm.

37. The varactor shunt switch of claim 1 has a parasitic series resistance when a signal is shunted to ground equal to the length of the line shunting to ground divided by the product of the conductivity of said metallic layer, the width of the conductor and the thickness of the conductor.

38. The varactor shunt switch of claim 1 has a parasitic line inductance equal to the characteristic impedance of said coplanar waveguide transmission line divided the product of 2π and the operating frequency multiplied by the sine of the product of 2π and the length of the line shunting to ground divided by the guide-wavelength.

39. The varactor shunt switch of claim 24 has a shunt resistance equal to one divided the product of ω, the capacitance of said varactor area and the loss-tangent of the ferrroelectric thin-film.

40. The varactor shunt switch of claim 39, wherein said shunt resistance models the lossy nature of said varactor.

41. A method of fabricating a varactor shunt switch, the method comprising:

depositing an adhesion layer on a high resistivity silicon substrate by electron-beam deposition and lift-off photolithography;

depositing a metallic layer on said adhesion layer by electron-beam deposition and lift-off photolithography;

covering said metallic layer with a layer of ferroelectric thin film by pulsed laser ablation, wherein said metallic layer comprises of at least two ground conductors and a shunt conductor;

topping said layer of ferroelectric thin film with a top metal electrode by electron-beam deposition and lift-off photolithography, wherein said top metal electrode comprises of at least two ground conductor and a center conductor; and

capping said top metal electrode with a coplanar waveguide transmission line comprised of at least two ground conductors and a signal strip.

42. The method of fabricating a varactor shunt switch of claim 41, further comprising:

tuning the capacitance of said varactor shunt switch by applying a dc electric field between said ground conductors of said metallic layer and said top metal electrode and said signal strip of a coplanar waveguide transmission line.